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NUMERICAL RESULTS FOR MUTUAL RADIATION IMPEDANCE COEFFICIENTS B--ETC(U)

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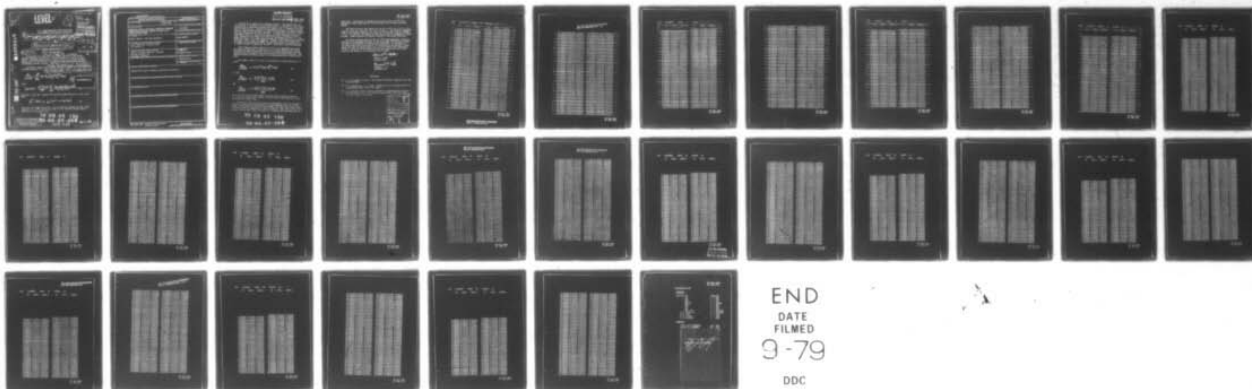
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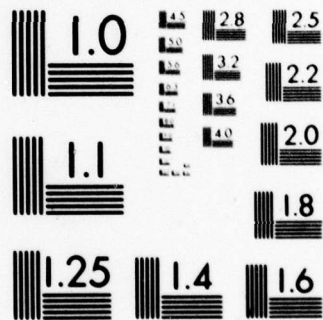
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U. S. Navy Underwater Sound Laboratory
Fort Trumbull, New London, Connecticut

(6) NUMERICAL RESULTS FOR MUTUAL RADIATION IMPEDANCE COEFFICIENTS
BETWEEN CIRCULAR PISTONS IN AN INFINITE RIGID PLANE

(10) David T. Porter and Bernard F. Cole

USL Technical Memorandum No. 960-17-65

(12) 35 P

(11) 10 March 1965

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In reference (a), Pritchard derived an equation for the mutual radiation impedance between two circular pistons in an infinite rigid baffle. This memorandum presents computer results for mutual impedance coefficients for various ka's, and discussed the difficulties involved in obtaining accurate results.

(9) Technical memo

Pritchard's equation for circular pistons of radius "a", and center-to-center spacing "d" is

(16) F00103

(17) SF0010313

$$\frac{Z_{12}}{\rho c \pi a^2} = \sum_{p=0}^{\infty} \sigma_p(ka) \left(\frac{a}{d}\right)^p h_p^{(2)}(kd)$$

where

$$\sigma_p(ka) = \frac{2 \Gamma(p + \frac{1}{2})}{\sqrt{\pi}} \sum_{n=0}^p \frac{J_{n+1}(ka) J_{p-n+1}(ka)}{n! (p-n)!} \quad (2)$$

and where $h_p(2)(kd)$ denotes the spherical Hankel Function of the second kind,

$$h_p^{(2)}(kd) \equiv j_p(kd) - i \pi_p(kd) \quad (3)$$

Pritchard used Hankel Functions of the second kind, because he used a time dependence of $e^{-i\omega t}$, which will result in the circular pistons having positive self reactances (X_{11}).

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For $d/a > 3$, equation (1) converges rapidly. The example done out by Pritchard in reference (a) shows that for $ka = 1$, and $kd = 3$, four place accuracy can be obtained by taking four terms in the "p" summation for R_{12} , and six terms for X_{12} . However, as d/a becomes closer to 2, which corresponds to the pistons touching, the number of terms needed increases rapidly, and hand computations are not practical. In particular, for $d/a = 2$, the convergence of X_{12} is very slow (although R_{12} still converges rapidly). Also, increasing ka further slows down the convergence for $d/a = 2$. For $ka \leq 1.58$, and $d = 2a$, three place accuracy can be obtained for X_{12} by using 28 terms or more in the "p" summation. However, other limitations often prevented us from taking 28 terms, such as the generation in equation (1) of numbers greater in magnitude than 10^{38} , which led to overflow problems.

The cylindrical Bessel Functions, $J_n(ka)$, were generated by reverse recursion, as described in reference (b), to avoid roundoff difficulties. The spherical Bessel Functions, $j_p(kd)$, were usually generated by reverse recursion, but for large kd had to be generated by forward recursion. The spherical Neuman Functions, $n_p(kd)$ were always generated by forward recursion.

When $d \gg a$, equation (1) may be approximated by taking just the $p = 0$ term.

$$\frac{Z_{12}}{\rho c \pi a^2} \rightarrow 2 J_1^2(ka) h_0^{(2)}(kd) \quad (4)$$

so that

$$\frac{R_{12}}{\rho c \pi a^2} \rightarrow \frac{2 J_1^2(ka) \sin kd}{kd} \quad (5)$$

and

$$\frac{X_{12}}{\rho c \pi a^2} \rightarrow \frac{2 J_1^2(ka) \cos kd}{kd} \quad (6)$$

Of course when ka approaches 3.832, the first zero of $J_1(ka)$, equations 4, 5 and 6 no longer hold. However, pistons with ka this large are rarely encountered in sonar arrays.

Reference (c) also contains results (in graphical form) for Pritchard's equation. These results are generally in good agreement with the results given in this report for $d/a > 3$, but reference (c) used only a small number of terms in the "p" summation, so that for $d/a < 3$, the results differ from those presented here. Also, reference (c) contains much less data than is

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given here. The results in reference (c) were also for an $e^{-i\omega t}$ time dependence, Hankel Functions of the second kind, and positive self reactances.

The tables given in this report are for $ka = 1.58, 1.5, 1.4, 1.3, 1.2, 1.0, 0.9, 0.8, 0.7, 0.6, 0.5, 0.4, 0.3, 0.2$ and 0.1 . For each ka , $R_{12}/\rho c A$ (RESIJ) and $X_{12}/\rho c A$ (REACIJ) are given for kd from $2ka$ to 20.0 , in steps of 0.1 . For each ka , the number of terms used in the "p" summation is given by JMAX. MSTAR concerns the reverse recursion of the Bessel Functions.

The tables presented here are for an $e^{+i\omega t}$ time dependence, which was obtained by using Hankel Functions of the first kind, and results in mutual reactances corresponding to negative self reactances. If one wishes to use these tables and is using the $e^{-i\omega t}$ convention in his problem, he must change the signs of the X_{12} given here, and use positive self reactances. If one is using the $e^{+i\omega t}$ convention, the tables given here may be used directly, but negative self reactances must be used.

David T. Porter

DAVID T. PORTER
Mathematician

Bernard F. Cole

BERNARD F. COLE
Mathematician

REFERENCES

- (a) R. L. Pritchard, Journal of the Acoustical Society of America, Vol. 32, 730-737 (1960).
- (b) J. B. Randels and K. F. Reeves, "Communications of the Association for Computing Machinery", May 1958, page 3.
- (3) E. L. Barrett, "Mutual Radiation Impedance Coefficients for Identical Circular Pistons in a Stiff Infinite Plane Baffle", USL Tech. Memo. No. 1150-39-58, 23 July 1958.

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KA= 0.100000 JMAX= 9 MSTAR= 5

KD	RFSIJ	RFACIJ	KD	RFSIJ	RFACIJ
0.300000	0.004917-0.016414		0.200000	0.004958-0.026399	
0.500000	0.004786-0.008869		0.400000	0.004860-0.011706	
0.700000	0.004594-0.005494		0.600000	0.004698-0.006929	
0.900000	0.004345-0.003468		0.800000	0.004476-0.004375	
1.100000	0.004045-0.002070		1.000000	0.004201-0.002712	
1.300000	0.003700-0.001035		1.200000	0.003877-0.001517	
1.500000	0.003320-0.000241		1.400000	0.003514-0.000613	
1.700000	0.002912 0.000374		1.600000	0.003119 0.000086	
1.900000	0.002487 0.000846		1.800000	0.002701 0.000626	
2.100000	0.002053 0.001197		2.000000	0.002270 0.001036	
2.300000	0.001619 0.001444		2.200000	0.001835 0.001333	
2.500000	0.001196 0.001598		2.400000	0.001406 0.001532	
2.700000	0.000791 0.001670		2.600000	0.000991 0.001643	
2.900000	0.000413 0.001670		2.800000	0.000598 0.001678	
3.100000	0.000068 0.001608		3.000000	0.000236 0.001646	
3.300000	-0.000237 0.001493		3.200000	-0.000090 0.001556	
3.500000	-0.000499 0.001335		3.400000	-0.000374 0.001419	
3.700000	-0.000714 0.001144		3.600000	-0.000612 0.001243	
3.900000	-0.000879 0.000929		3.800000	-0.000803 0.001039	
4.100000	-0.000995 0.000760		4.000000	-0.000943 0.000816	
4.300000	-0.001062 0.000486		4.200000	-0.001035 0.000583	
4.500000	-0.001083 0.000234		4.400000	-0.001079 0.000349	
4.700000	-0.001061 0.000014		4.600000	-0.001077 0.000122	
4.900000	-0.001000-0.000189		4.800000	-0.001035-0.000090	
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5.500000	-0.000640-0.000642		5.400000	-0.000714-0.000586	
5.700000	-0.000482-0.000730		5.600000	-0.000562-0.000691	
5.900000	-0.000316-0.000784		5.800000	-0.000400-0.000761	
6.100000	-0.000149-0.000804		6.000000	-0.000232-0.000799	
6.300000	0.000013-0.000792		6.200000	-0.000067-0.000802	
6.500000	0.000165-0.000749		6.400000	0.000091-0.000774	
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6.900000	0.000420-0.000590		6.800000	0.000363-0.000638	
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7.700000	0.000639-0.000100		7.600000	0.000634-0.000165	
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8.700000	0.000380 0.000429		8.600000	0.000426 0.000394	
8.900000	0.000281 0.000485		8.800000	0.000331 0.000460	
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14.900000 0.000242 0.000231	15.000000 0.000216 0.000253
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15.500000 0.000066 0.000315	15.600000 0.000034 0.000318
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18.900000 0.000013-0.000264	19.000000 0.000039-0.000260
19.100000 0.000065-0.000253	19.200000 0.000089-0.000244
19.300000 0.000113-0.000233	19.400000 0.000134-0.000219
19.500000 0.000155-0.000204	19.600000 0.000174-0.000186
19.700000 0.000190-0.000167	19.800000 0.000205-0.000146
19.900000 0.000217-0.000125	20.000000 0.000228-0.000102

KA= 0.200000

JMAX= 4

MSTAR= 6

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0.900000	0.017295	-0.014053	0.800000	0.017817	-0.017764
1.100000	0.016101	-0.008385	1.000000	0.016722	-0.010982
1.300000	0.014732	-0.004214	1.200000	0.015437	-0.006153
1.500000	0.013220	-0.001027	1.400000	0.013992	-0.002518
1.700000	0.011529	0.001437	1.600000	0.012421	0.000284
1.900000	0.009907	0.003326	1.800000	0.010760	0.002447
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2.300000	0.006457	0.005719	2.200000	0.007316	0.005274
2.500000	0.004773	0.006336	2.400000	0.005608	0.006071
2.700000	0.003163	0.006627	2.600000	0.003957	0.006520
2.900000	0.001658	0.006632	2.800000	0.002396	0.006663
3.100000	0.000287	0.006388	3.000000	0.000954	0.006538
3.300000	-0.000929	0.005933	3.200000	-0.000342	0.006184
3.500000	-0.001971	0.005308	3.400000	-0.001473	0.005640
3.700000	-0.002825	0.004550	3.600000	-0.002422	0.004943
3.900000	-0.003485	0.003697	3.800000	-0.003180	0.004133
4.100000	-0.003947	0.002787	4.000000	-0.003741	0.003247
4.300000	-0.004217	0.001856	4.200000	-0.004106	0.002322
4.500000	-0.004301	0.000938	4.400000	-0.004281	0.001394
4.700000	-0.004214	0.000061	4.600000	-0.004278	0.000492
4.900000	-0.003973	0.000746	4.800000	-0.004112	0.000353
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14.700000 0.001141 0.000718	14.800000 0.001057 0.000823
14.900000 0.000962 0.000918	15.000000 0.000860 0.001002
15.100000 0.000751 0.001076	15.200000 0.000635 0.001138
15.300000 0.000515 0.001188	15.400000 0.000391 0.001225
15.500000 0.000264 0.001250	15.600000 0.000137 0.001262
15.700000 0.000010 0.001261	15.800000-0.000115 0.001248
15.900000-0.000238 0.001223	16.000000-0.000357 0.001185
16.100000-0.000471 0.001137	16.200000-0.000579 0.001078
16.300000-0.000680 0.001008	16.400000-0.000773 0.000930
16.500000-0.000858 0.000843	16.600000-0.000932 0.000749
16.700000-0.000997 0.000649	16.800000-0.001051 0.000544
16.900000-0.001094 0.000434	17.000000-0.001126 0.000321
17.100000-0.001147 0.000207	17.200000-0.001156 0.000091
17.300000-0.001154-0.000024	17.400000-0.001140-0.000137
17.500000-0.001116-0.000248	17.600000-0.001082-0.000355
17.700000-0.001039-0.000457	17.800000-0.000988-0.000553
17.900000-0.000935-0.000643	18.000000-0.000912-0.000726
18.100000-0.000831-0.000800	18.200000-0.000629-0.000866
18.300000-0.000551-0.000922	18.400000-0.000459-0.000969
18.500000-0.000361-0.001005	18.600000-0.000260-0.001031
18.700000-0.000156-0.001047	18.800000-0.000052-0.001052
18.900000 0.000052-0.001046	19.000000 0.000155-0.001030
19.100000 0.000255-0.001005	19.200000 0.000352-0.000969
19.300000 0.000444-0.000924	19.400000 0.000531-0.000870
19.500000 0.000612-0.000808	19.600000 0.000686-0.000739
19.700000 0.000753-0.000663	19.800000 0.000811-0.000582
19.900000 0.000860-0.000495	20.000000 0.000901-0.000404

KA= 0.300000

JMAX= 6

MSTAR= 8

KD	RESIJ	REACIJ	KD	RESIJ	REACIJ
0.700000	0.040808-0.052347		0.600000	0.041726-0.067723	
0.900000	0.038600-0.032392		0.800000	0.039764-0.041145	
1.100000	0.035940-0.019286		1.000000	0.037323-0.025260	
1.300000	0.032891-0.009774		1.200000	0.034460-0.014185	
1.500000	0.029522-0.002554		1.400000	0.031241-0.005926	
1.700000	0.025911-0.003009		1.600000	0.027742-0.000409	
1.900000	0.022140-0.007266		1.800000	0.024041-0.005285	
2.100000	0.018293-0.010432		2.000000	0.020221-0.008975	
2.300000	0.014452-0.012657		2.200000	0.016366-0.011655	
2.500000	0.010699-0.014053		2.400000	0.012560-0.013452	
2.700000	0.007110-0.014718		2.600000	0.008879-0.014471	
2.900000	0.003755-0.014741		2.800000	0.005399-0.014804	
3.100000	0.000696-0.014209		3.000000	0.002185-0.014539	
3.300000	0.002017-0.013207		3.200000	0.000707-0.013761	
3.500000	0.004341-0.011822		3.400000	0.003229-0.012557	
3.700000	0.006249-0.010140		3.600000	0.005348-0.011012	
3.900000	0.007722-0.008246		3.800000	0.007040-0.009214	
4.100000	0.008758-0.006225		4.000000	0.008295-0.007247	
4.300000	0.009364-0.004155		4.200000	0.009114-0.005191	
4.500000	0.009557-0.002111		4.400000	0.009510-0.003126	
4.700000	0.009369-0.000161		4.600000	0.009509-0.001121	
4.900000	0.008837-0.001635		4.800000	0.009143-0.000760	
5.100000	0.008008-0.003228		5.000000	0.008457-0.002460	
5.300000	0.006934-0.004576		5.200000	0.007498-0.003935	
5.500000	0.005671-0.005650		5.400000	0.006323-0.005149	
5.700000	0.004279-0.006430		5.600000	0.004988-0.006078	
5.900000	0.002816-0.006910		5.800000	0.003553-0.006708	
6.100000	0.001340-0.007091		6.000000	0.002076-0.007037	
6.300000	0.000075-0.006987		6.200000	0.000614-0.007074	
6.500000	0.001433-0.006619		6.400000	0.000776-0.006834	
6.700000	0.002639-0.006016		6.600000	0.002055-0.006345	
6.900000	0.003672-0.005216		6.800000	0.003179-0.005638	
7.100000	0.004505-0.004258		7.000000	0.004115-0.004754	
7.300000	0.005117-0.003188		7.200000	0.004839-0.003734	
7.500000	0.005497-0.002051		7.400000	0.005336-0.002625	
7.700000	0.005644-0.000893		7.600000	0.005600-0.001472	
7.900000	0.005564-0.000240		7.800000	0.005632-0.000321	
8.100000	0.005271-0.001309		8.000000	0.005443-0.000785	
8.300000	0.004787-0.002274		8.200000	0.005052-0.001806	
8.500000	0.004139-0.003106		8.400000	0.004482-0.002709	
8.700000	0.003359-0.003778		8.600000	0.003764-0.003463	
8.900000	0.002483-0.004273		8.800000	0.002931-0.004043	
9.100000	0.001548-0.004579		9.000000	0.002020-0.004450	
9.300000	0.000591-0.004694		9.200000	0.001070-0.004661	
9.500000	0.000350-0.004620		9.400000	0.000116-0.004680	
9.700000	0.001241-0.004369		9.600000	0.000804-0.004516	
9.900000	0.002056-0.003957		9.800000	0.001660-0.004182	
			10.000000	0.002429-0.003698	

10.100000-0.004725 0.005961	10.200000-0.005245 0.005405
10.300000-0.005702 0.004806	10.400000-0.006095 0.004171
10.500000-0.006419 0.003507	10.600000-0.006673 0.002820
10.700000-0.006856 0.002119	10.800000-0.006968 0.001409
10.900000-0.007009 0.000699	11.000000-0.006979-0.000005
11.100000-0.006881-0.000697	11.200000-0.006716-0.001360
11.300000-0.006487-0.002016	11.400000-0.006198-0.002632
11.500000-0.005852-0.003210	11.600000-0.005454-0.003747
11.700000-0.005008-0.004238	11.800000-0.004521-0.004678
11.900000-0.003996-0.005064	12.000000-0.003441-0.005394
12.100000-0.002860-0.005665	12.200000-0.002260-0.005875
12.300000-0.001648-0.006024	12.400000-0.001029-0.006110
12.500000-0.000409-0.006135	12.600000 0.000206-0.006098
12.700000 0.000808-0.006001	12.800000 0.001394-0.005847
12.900000 0.001957-0.005636	13.000000 0.002493-0.005374
13.100000 0.002996-0.005061	13.200000 0.003462-0.004704
13.300000 0.003887-0.004305	13.400000 0.004268-0.003869
13.500000 0.004601-0.003401	13.600000 0.004884-0.002907
13.700000 0.005116-0.002390	13.800000 0.005295-0.001858
13.900000 0.005419-0.001315	14.000000 0.005489-0.000766
14.100000 0.005506-0.000218	14.200000 0.005471 0.000325
14.300000 0.005385 0.000856	14.400000 0.005254 0.001372
14.500000 0.005086 0.001868	14.600000 0.004900 0.002338
14.700000 0.004798 0.002778	14.800000 0.001080 0.003185
14.900000 0.003471 0.003555	15.000000 0.003211 0.003884
15.100000 0.002836 0.004171	15.200000 0.002414 0.004412
15.300000 0.001964 0.004606	15.400000 0.001494 0.004752
15.500000 0.001013 0.004850	15.600000 0.000526 0.004897
15.700000 0.000039 0.004896	15.800000-0.000444 0.004845
15.900000-0.000917 0.004748	16.000000-0.001375 0.004604
16.100000-0.001814 0.004417	16.200000-0.002230 0.004187
16.300000-0.002619 0.003920	16.400000-0.002978 0.003616
16.500000-0.003302 0.003280	16.600000-0.003520 0.002916
16.700000-0.003839 0.002527	16.800000-0.004047 0.002117
16.900000-0.004212 0.001692	17.000000-0.004334 0.001254
17.100000-0.004411 0.000810	17.200000-0.004443 0.000362
17.300000-0.004431-0.000084	17.400000-0.004375-0.000524
17.500000-0.004275-0.000954	17.600000-0.004135-0.001369
17.700000-0.003955-0.001767	17.800000-0.003737-0.002142
17.900000-0.003485-0.002491	18.000000-0.003201-0.002812
18.100000-0.002888-0.003102	18.200000-0.002550-0.003357
18.300000-0.002191-0.003577	18.400000-0.001813-0.003758
18.500000-0.001421-0.003900	18.600000-0.001019-0.004002
18.700000-0.000612-0.004063	18.800000-0.000202-0.004083
18.900000 0.000205-0.004062	19.000000 0.000606-0.004071
19.100000 0.000996-0.003901	19.200000 0.001373-0.003763
19.300000 0.001732-0.003589	19.400000 0.002071-0.003381
19.500000 0.002385-0.003142	19.600000 0.002672-0.002874
19.700000 0.002930-0.002580	19.800000 0.003157-0.002263
19.900000 0.003349-0.001927	20.000000 0.003507-0.001575

KA= 0.400000 JMAX= 8 MSTAR= 10

KD	RFSIJ	REACIJ	KD	RFSIJ	REACIJ
0.900000	0.067850	-0.060027	0.800000	0.069891	-0.077274
1.100000	0.063187	-0.035472	1.000000	0.065611	-0.046535
1.300000	0.057840	-0.018153	1.200000	0.060591	-0.026149
1.500000	0.051933	-0.005164	1.400000	0.054948	-0.011218
1.700000	0.045602	0.004785	1.600000	0.048812	0.000139
1.900000	0.038989	0.012374	1.800000	0.042321	0.008844
2.100000	0.032241	0.018014	2.000000	0.035623	0.015418
2.300000	0.025504	0.021980	2.200000	0.028862	0.020192
2.500000	0.018919	0.024479	2.400000	0.022184	0.023401
2.700000	0.012622	0.025686	2.600000	0.015727	0.025234
2.900000	0.006733	0.025761	2.800000	0.009619	0.025855
3.100000	0.001362	0.024856	3.000000	0.003977	0.025421
3.300000	-0.003402	0.023124	3.200000	-0.001109	0.024084
3.500000	-0.007487	0.020717	3.400000	-0.005533	0.021996
3.700000	-0.010842	0.017787	3.600000	-0.009258	0.019308
3.900000	-0.013438	0.014483	3.800000	-0.012336	0.016172
4.100000	-0.015267	0.010952	4.000000	-0.014448	0.012737
4.300000	-0.016341	0.007339	4.200000	-0.015896	0.009145
4.500000	-0.016694	0.003757	4.400000	-0.016605	0.005532
4.700000	-0.016377	0.000344	4.600000	-0.016615	0.002024
4.900000	-0.015458	-0.002803	4.800000	-0.015988	-0.001269
5.100000	-0.014017	-0.005593	5.000000	-0.014797	-0.004247
5.300000	-0.012146	-0.007958	5.200000	-0.013129	-0.006833
5.500000	-0.009944	-0.009842	5.400000	-0.011080	-0.008962
5.700000	-0.007514	-0.011215	5.600000	-0.008751	-0.010594
5.900000	-0.004958	-0.012061	5.800000	-0.006245	-0.011704
6.100000	-0.002379	-0.012386	6.000000	-0.003666	-0.012288
6.300000	0.000127	-0.012210	6.200000	-0.001111	-0.012358
6.500000	0.002474	-0.011573	6.400000	0.001325	-0.011946
6.700000	0.004585	-0.010525	6.600000	0.003563	-0.011097
6.900000	0.006395	-0.009131	6.800000	0.005531	-0.009867
7.100000	0.007854	-0.007460	7.000000	0.007171	-0.008325
7.300000	0.008929	-0.005592	7.200000	0.008441	-0.006546
7.500000	0.009599	-0.003606	7.400000	0.009315	-0.004609
7.700000	0.009861	-0.001584	7.600000	0.009781	-0.002594
7.900000	0.009726	0.000398	7.800000	0.009842	-0.000583
8.100000	0.009219	0.002266	8.000000	0.009517	0.001351
8.300000	0.008377	0.003956	8.200000	0.008837	0.003137
8.500000	0.007248	0.005412	8.400000	0.007845	0.004716
8.700000	0.005889	0.006589	8.600000	0.006594	0.006038
8.900000	0.004360	0.007457	8.800000	0.005141	0.007064
9.100000	0.002727	0.007996	9.000000	0.003552	0.007768
9.300000	0.001053	0.008199	9.200000	0.001892	0.008139
9.500000	-0.001833	0.008073	9.400000	0.000212	0.008176
9.700000	-0.002104	0.007637	9.600000	-0.001329	0.007892
9.900000	-0.003513	0.006920	9.800000	-0.002831	0.007311
			10.000000	-0.004146	0.006468

KA= 0.500000 JMAX= 10

MSTAR= 12

KD RESIJ REACIJ KD RESIJ REACIJ

1.100000	0.097328	-0.058382	1.000000	0.101048	-0.077201
1.300000	0.089121	-0.030101	1.200000	0.093344	-0.043033
1.500000	0.080054	-0.009388	1.400000	0.084682	-0.019006
1.700000	0.070335	0.006314	1.600000	0.075263	-0.001005
1.900000	0.060183	0.018236	1.800000	0.065299	0.012696
2.100000	0.049821	0.027079	2.000000	0.055014	0.023009
2.300000	0.039474	0.033302	2.200000	0.044632	0.030495
2.500000	0.029360	0.037243	2.400000	0.034375	0.035540
2.700000	0.019684	0.039181	2.600000	0.024455	0.038446
2.900000	0.010634	0.039365	2.800000	0.015070	0.039477
3.100000	0.002374	0.038036	3.000000	0.006396	0.038875
3.300000	-0.004955	0.035428	3.200000	-0.001414	0.036877
3.500000	-0.011244	0.031777	3.400000	-0.008235	0.033718
3.700000	-0.016415	0.027315	3.600000	-0.013973	0.029633
3.900000	-0.020422	0.022275	3.800000	-0.018566	0.024854
4.100000	-0.023253	0.016882	4.000000	-0.021984	0.019609
4.300000	-0.024928	0.011349	4.200000	-0.024233	0.014120
4.500000	-0.025496	0.005877	4.400000	-0.025346	0.008593
4.700000	-0.025036	0.000649	4.600000	-0.025389	0.003222
4.900000	-0.023652	-0.004173	4.800000	-0.024453	-0.001821
5.100000	-0.021467	-0.008453	5.000000	-0.022651	-0.006388
5.300000	-0.018620	-0.012083	5.200000	-0.020116	-0.010355
5.500000	-0.015263	-0.014980	5.400000	-0.016995	-0.013627
5.700000	-0.011553	-0.017095	5.600000	-0.013442	-0.016138
5.900000	-0.007650	-0.018404	5.800000	-0.009616	-0.017850
6.100000	-0.003708	-0.018915	6.000000	-0.005675	-0.018758
6.300000	0.000126	-0.018661	6.200000	-0.001769	-0.018881
6.500000	0.003718	-0.017699	6.400000	0.001960	-0.018264
6.700000	0.006951	-0.016109	6.600000	0.005386	-0.016977
6.900000	0.009725	-0.013985	6.800000	0.008401	-0.015107
7.100000	0.011965	-0.011439	7.000000	0.010916	-0.012758
7.300000	0.013617	-0.008588	7.200000	0.012867	-0.010044
7.500000	0.014651	-0.005555	7.400000	0.014212	-0.007086
7.700000	0.015060	-0.002465	7.600000	0.014933	-0.004010
7.900000	0.014863	0.000565	7.800000	0.015036	-0.000935
8.100000	0.014096	0.003423	8.000000	0.014547	0.002022
8.300000	0.012817	0.006009	8.200000	0.013516	0.004755
8.500000	0.011098	0.008239	8.400000	0.012007	0.007173
8.700000	0.009026	0.010044	8.600000	0.010100	0.009198
8.900000	0.006694	0.011376	8.800000	0.007886	0.010772
9.100000	0.004204	0.012205	9.000000	0.005463	0.011855
9.300000	0.001656	0.012522	9.200000	0.002931	0.012428
9.500000	-0.000843	0.012336	9.400000	0.000384	0.012490
9.700000	-0.003213	0.011675	9.600000	-0.002051	0.012062
9.900000	-0.005360	0.010584	9.800000	-0.004319	0.011180
			10.000000	-0.006326	0.009896

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No. 960-17-65

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10.100000-0.002786 0.003407	10.200000-0.003175 0.003088
10.300000-0.002545 0.002745	10.400000-0.003379 0.002381
10.500000-0.003616 0.002001	10.600000-0.003781 0.001608
10.700000-0.003895 0.001206	10.800000-0.003965 0.000800
10.900000-0.003992 0.000394	11.000000-0.003978-0.000009
11.100000-0.003923-0.000405	11.200000-0.003831-0.000790
11.300000-0.003701-0.001160	11.400000-0.003536-0.001512
11.500000-0.003339-0.001843	11.600000-0.003113-0.002150
11.700000-0.002858-0.002430	11.800000-0.002580-0.002682
11.900000-0.002281-0.002902	12.000000-0.001964-0.003091
12.100000-0.001632-0.003245	12.200000-0.001290-0.003365
12.300000-0.000940-0.003450	12.400000-0.000587-0.003490
12.500000-0.000233-0.003512	12.600000 0.000117-0.003491
12.700000 0.000461-0.003435	12.800000 0.000795-0.003346
12.900000 0.001116-0.003225	13.000000 0.001421-0.003074
13.100000 0.001707-0.002895	13.200000 0.001972-0.002690
13.300000 0.002214-0.002461	13.400000 0.002430-0.002211
13.500000 0.002618-0.001943	13.600000 0.002778-0.001660
13.700000 0.002908-0.001365	13.800000 0.003008-0.001060
13.900000 0.003076-0.000749	14.000000 0.003112-0.000435
14.100000 0.003118-0.000121	14.200000 0.003092 0.000190
14.300000 0.003036 0.000494	14.400000 0.002950 0.000789
14.500000 0.002837 0.001073	14.600000 0.002696 0.001341
14.700000 0.002531 0.001593	14.800000 0.002343 0.001826
14.900000 0.002135 0.002037	15.000000 0.001908 0.002226
15.100000 0.001665 0.002389	15.200000 0.001408 0.002527
15.300000 0.001141 0.002638	15.400000 0.000866 0.002722
15.500000 0.000586 0.002777	15.600000 0.000304 0.002804
15.700000 0.000022 0.002802	15.800000-0.000256 0.002773
15.900000-0.000528 0.002717	16.000000-0.000792 0.002635
16.100000-0.001045 0.002527	16.200000-0.001284 0.002396
16.300000-0.001507 0.002242	16.400000-0.001713 0.002068
16.500000-0.001899 0.001876	16.600000-0.002064 0.001667
16.700000-0.002207 0.001444	16.800000-0.002326 0.001210
16.900000-0.002420 0.000966	17.000000-0.002490 0.000715
17.100000-0.002534 0.000461	17.200000-0.002552 0.000205
17.300000-0.002544-0.000051	17.400000-0.002512-0.000303
17.500000-0.002455-0.000549	17.600000-0.002374-0.000786
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19.900000 0.001921-0.001101	20.000000 0.002011-0.000900

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2.500000	0.041928 0.051879	2.400000	0.049000 0.049388
2.700000	0.028278 0.054762	2.600000	0.035009 0.053655
2.900000	0.015505 0.055147	2.800000	0.021766 0.055244
3.100000	0.003843 0.053379	3.000000	0.009522 0.054511
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3.700000	-0.022730 0.038506	3.600000	-0.019270 0.041739
3.900000	-0.028416 0.031461	3.800000	-0.025779 0.035066
4.100000	-0.032447 0.023907	4.000000	-0.030637 0.027728
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4.500000	-0.035697 0.008469	4.400000	-0.035463 0.012283
4.700000	-0.035096 0.001125	4.600000	-0.035570 0.004740
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KD

RESIJ

REACIJ

KD

RESIJ

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THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

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2.700000	0.049950	0.090004	2.600000	0.061308	0.087802
2.900000	0.028381	0.091236	2.800000	0.038958	0.091123
3.100000	0.008662	0.088748	3.000000	0.018268	0.090420
3.300000	0.008879	0.083130	3.200000	0.000399	0.086294
3.500000	0.023980	0.074957	3.400000	0.016748	0.079327
3.700000	0.036453	0.064795	3.600000	0.030553	0.070089
3.900000	0.046188	0.053201	3.800000	0.041667	0.059143
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4.300000	0.057392	0.027835	4.200000	0.055608	0.034290
4.500000	0.059017	0.015054	4.400000	0.058521	0.021405
4.700000	0.058212	0.002802	4.600000	0.058905	0.008837
4.900000	0.055214	0.008538	4.800000	0.056970	0.003004
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5.300000	0.043831	0.027241	5.200000	0.047247	0.023142
5.500000	0.036126	0.034149	5.400000	0.040109	0.030916
5.700000	0.027565	0.039236	5.600000	0.031929	0.036925
5.900000	0.018520	0.042447	5.800000	0.023080	0.041077
6.100000	0.009355	0.043792	6.000000	0.013931	0.043349
6.300000	0.000415	0.043346	6.200000	0.004837	0.043786
6.500000	0.007984	0.041239	6.400000	0.003870	0.042490
6.700000	0.015566	0.037652	6.600000	0.011893	0.039617
6.900000	0.022097	0.032806	6.800000	0.018976	0.035371
7.100000	0.027394	0.026957	7.000000	0.024909	0.029990
7.300000	0.031330	0.020379	7.200000	0.029538	0.023741
7.500000	0.033831	0.013359	7.400000	0.032762	0.016906
7.700000	0.034879	0.006185	7.600000	0.034535	0.009773
7.900000	0.034511	0.000865	7.800000	0.034868	0.002628
8.100000	0.032813	0.007530	8.000000	0.033821	0.004261
8.300000	0.029914	0.013577	8.200000	0.031504	0.010644
8.500000	0.025982	0.018807	8.400000	0.028065	0.016306
8.700000	0.021216	0.023059	8.600000	0.023690	0.021064
8.900000	0.015835	0.026217	8.800000	0.018588	0.024780
9.100000	0.010072	0.028208	9.000000	0.012986	0.027361
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9.700000	0.007173	0.027162	9.600000	0.004467	0.028034
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			10.000000	0.014444	0.023105

USL Tech. Memo.
No. 960-17-65

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USL Tech. Memo.
No. 960-17-65

KA= 0.900000

JMAX= 16

MSTAR= 18

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KD RESIJ REACTJ

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2.900000	0.036502	0.110378	2.800000	0.049477	0.110012
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3.300000	-0.009262	0.101185	3.200000	0.001162	0.104898
3.500000	-0.027846	0.091464	3.400000	-0.018942	0.096677
3.700000	-0.043228	0.079269	3.600000	-0.035948	0.085633
3.900000	-0.055272	0.065284	3.800000	-0.049672	0.072459
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4.300000	-0.069271	0.034553	4.200000	-0.067013	0.042386
4.500000	-0.071414	0.019023	4.400000	-0.070730	0.026743
4.700000	-0.070586	0.004111	4.600000	-0.071355	0.011458
4.900000	-0.067074	-0.009712	4.800000	-0.069145	-0.002963
5.100000	-0.061229	-0.022045	5.000000	-0.064420	-0.016086
5.300000	-0.053448	-0.032567	5.200000	-0.057555	-0.027549
5.500000	-0.044160	-0.041038	5.400000	-0.048968	-0.037070
5.700000	-0.033813	-0.047302	5.600000	-0.039091	-0.044452
5.900000	-0.022861	-0.051288	5.800000	-0.028385	-0.049581
6.100000	-0.011747	-0.053007	6.000000	-0.017297	-0.052427
6.300000	-0.000890	-0.052546	6.200000	-0.006261	-0.053041
6.500000	0.009323	-0.050061	6.400000	0.004319	-0.051544
6.700000	0.018554	-0.045772	6.600000	0.014081	-0.048127
6.900000	0.026519	-0.039946	6.800000	0.022710	-0.043032
7.100000	0.032993	-0.032890	7.000000	0.029953	-0.036551
7.300000	0.037818	-0.024940	7.200000	0.035619	-0.029006
7.500000	0.040904	-0.016443	7.400000	0.039581	-0.020738
7.700000	0.042228	-0.007748	7.600000	0.041785	-0.012099
7.900000	0.041832	0.000805	7.800000	0.042240	-0.003434
8.100000	0.039818	0.008900	8.000000	0.041019	0.004928
8.300000	0.036344	0.016254	8.200000	0.038252	0.012686
8.500000	0.031610	0.022622	8.400000	0.034120	0.019575
8.700000	0.025858	0.027809	8.600000	0.028845	0.025373
8.900000	0.019353	0.031671	8.800000	0.022682	0.029913
9.100000	0.012377	0.034121	9.000000	0.015906	0.033076
9.300000	0.005218	0.035127	9.200000	0.008803	0.034805
9.500000	-0.001842	0.034713	9.400000	0.001659	0.035094
9.700000	-0.008537	0.032955	9.600000	-0.005251	0.033996
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USL Tech. Memo.

No. 960-17-65

COLUMBIA UNIVERSITY
RUSSELL LABORATORIES
CONTRACT Nonr-266(34)

10.100000-0.019896	0.025937	10.200000-0.022171	0.023583		
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11.900000-0.017525	-0.021492	12.000000-0.015160	-0.022943		
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12.500000-0.002194	-0.026306	12.600000	0.000443-0.026183		
12.700000	0.003034-0.025803	12.800000	0.005555-0.025172		
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13.300000	0.016316-0.018685	13.400000	0.017966-0.016834		
13.500000	0.019414-0.014843	13.600000	0.020647-0.012734		
13.700000	0.021657-0.010529	13.800000	0.022436-0.008251		
13.900000	0.022982-0.005925	14.000000	0.023291-0.003572		
14.100000	0.023364-0.001218	14.200000	0.023204	0.001115	
14.300000	0.022815	0.003405	14.400000	0.022205	0.005628
14.500000	0.021383	0.007765	14.600000	0.020359	0.009795
14.700000	0.019146	0.011701	14.800000	0.017760	0.013464
14.900000	0.016215	0.015069	15.000000	0.014530	0.016504
15.100000	0.012723	0.017755	15.200000	0.010812	0.018813
15.300000	0.008818	0.019670	15.400000	0.006762	0.020320
15.500000	0.004662	0.020760	15.600000	0.002532	0.020987
15.700000	0.000269	0.021003	15.800000	-0.001583	0.020810
15.900000	-0.003660	0.020413	16.000000	-0.005653	0.019817
16.100000	-0.007561	0.019032	16.200000	-0.009368	0.018067
16.300000	-0.011059	0.016934	16.400000	-0.012618	0.015647
16.500000	-0.014032	0.014220	16.600000	-0.015290	0.012668
16.700000	-0.016379	0.011009	16.800000	-0.017293	0.009261
16.900000	-0.018023	0.007441	17.000000	-0.018565	0.005568
17.100000	-0.018916	0.003662	17.200000	-0.019073	0.001742
17.300000	-0.019039	-0.000173	17.400000	-0.018816	-0.002065
17.500000	-0.018407	-0.003914	17.600000	-0.017819	-0.005704
17.700000	-0.017059	-0.007416	17.800000	-0.016138	-0.009035
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18.100000	-0.012515	-0.013191	18.200000	-0.011065	-0.014302
18.300000	-0.00	519-0.015258	18.400000	-0.007892	-0.016051
18.500000	-0.006	0-0.016677	18.600000	-0.004460	-0.017129
18.700000	-0.002686	-0.017407	18.800000	-0.000892	-0.017508
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19.100000	0.004566	-0.01672	19.200000	0.006623	-0.016194
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KA= 1.000000 JMAX= 28

MSTAR= 30

KD RESIJ REACIJ

KD RESIJ REACIJ

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8.900000 0.022969 0.037098
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14.500000	0.025163	0.009036	14.600000	0.023968	0.011427
14.700000	0.022551	0.013672	14.800000	0.020929	0.015750
14.900000	0.019121	0.017644	15.000000	0.017146	0.019337
15.100000	0.015027	0.020814	15.200000	0.012787	0.022066
15.300000	0.010448	0.023081	15.400000	0.008037	0.023854
15.500000	0.005576	0.024379	15.600000	0.003092	0.024655
15.700000	0.000608	0.024682	15.800000	0.001850	0.024463
15.900000	0.004258	0.024003	16.000000	0.006594	0.023311
16.100000	0.008835	0.022395	16.200000	0.010961	0.021268
16.300000	0.012951	0.019942	16.400000	0.014788	0.018435
16.500000	0.016456	0.016763	16.600000	0.017940	0.014944
16.700000	0.019227	0.012998	16.800000	0.020308	0.010946
16.900000	0.021174	0.008809	17.000000	0.021819	0.006610
17.100000	0.022239	0.004371	17.200000	0.022433	0.002114
17.300000	0.000000-0.000137		17.400000	0.01500000-0.002361	
17.500000	0.000000-0.004536		17.600000	0.000000-0.006641	
17.700000	0.000000-0.008657		17.800000	0.000000-0.010563	
17.900000	0.000000-0.012343		18.000000	0.000000-0.013980	
18.100000	0.000000-0.015460		18.200000	0.000000-0.016770	
18.300000	0.000000-0.017899		18.400000	0.000000-0.019400	
18.500000	0.000000-0.020000		18.600000	0.000000-0.021667	
18.700000	0.000000-0.021667		18.800000	0.000000-0.023000	
18.900000	0.000000-0.022917		19.000000	0.000000-0.023833	
19.100000	0.000000-0.024167		19.200000	0.000000-0.024167	
19.300000	0.000000-0.024167		19.400000	0.000000-0.023833	
19.500000	0.000000-0.022917		19.600000	0.000000-0.021667	
19.700000	0.000000-0.020000		19.800000	0.000000-0.019400	
19.900000	0.000000-0.017899		20.000000	0.000000-0.016770	

KA= 1.200000

JMAX= 28

MSTAR= 30

KD RESIJ REACIJ

KD RESIJ REACIJ

2.500000 0.154632 0.140707
2.700000 0.110084 0.157287
2.900000 0.068226 0.163977
3.100000 0.029805 0.162604
3.300000-0.004546 0.154602
3.500000-0.034324 0.141242
3.700000-0.059163 0.123703
3.900000-0.078841 0.103106
4.100000-0.093283 0.080518
4.300000-0.102554 0.056941
4.500000-0.106859 0.033309
4.700000-0.106522 0.010468
4.900000-0.101982-0.010837
5.100000-0.093768-0.029969
5.300000-0.082486-0.046414
5.500000-0.068790-0.059783
5.700000-0.053369-0.069821
5.900000-0.036918-0.076400
6.100000-0.020120-0.079520
6.300000-0.003623-0.079301
6.500000 0.011977-0.075969
6.700000 0.026151-0.069847
6.900000 0.038456-0.061335
7.100000 0.048539-0.050897
7.300000 0.056147-0.039037
7.500000 0.061131-0.026283
7.700000 0.063444-0.013169
7.900000 0.063140-0.000210
8.100000 0.060366 0.012106
8.300000 0.055351 0.023344
8.500000 0.048396 0.033127
8.700000 0.039859 0.041150
8.900000 0.030141 0.047187
9.100000 0.019669 0.051098
9.300000 0.008879 0.052827
9.500000-0.001803 0.052402
9.700000-0.011968 0.049932
9.900000-0.021247 0.045595

2.400000 0.177653 0.127867
2.600000 0.132072 0.150376
2.800000 0.088770 0.161740
3.000000 0.048544 0.164203
3.200000 0.012086 0.159350
3.400000-0.020033 0.148517
3.600000-0.047378 0.132923
3.800000-0.069655 0.113719
4.000000-0.086716 0.091997
4.200000-0.098555 0.068793
4.400000-0.105310 0.045077
4.600000-0.107246 0.021741
4.800000-0.104746-0.000419
5.000000-0.098298-0.020710
5.200000-0.088471-0.038555
5.400000-0.075897-0.053502
5.600000-0.061252-0.065230
5.800000-0.045229-0.073546
6.000000-0.028521-0.078388
6.200000-0.011795-0.079816
6.400000 0.004324-0.078006
6.600000 0.019272-0.073234
6.800000 0.032562-0.065862
7.000000 0.043793-0.056326
7.200000 0.052664-0.045112
7.400000 0.058972-0.032738
7.600000 0.062620-0.019738
7.800000 0.063612-0.006639
8.000000 0.062050 0.006057
8.200000 0.058121 0.017885
8.400000 0.052094 0.028438
8.600000 0.044301 0.037375
8.800000 0.035122 0.044428
9.000000 0.024973 0.049414
9.200000 0.014287 0.052236
9.400000 0.003498 0.052879
9.600000-0.006974 0.051413
9.800000-0.016739 0.047983
10.000000-0.025451 0.042801

10.100000-0.029318	0.039636	10.200000-0.032816	0.036139		
10.300000-0.035918	0.032350	10.400000-0.038602	0.028312		
10.500000-0.040849	0.024069	10.600000-0.042647	0.019667		
10.700000-0.043986	0.015152	10.800000-0.044861	0.010570		
10.900000-0.045273	0.005968	11.000000-0.045226	0.001391		
11.100000-0.044730-0.003117		11.200000-0.043796-0.007513			
11.300000-0.042443-0.011756		11.400000-0.040691-0.015806			
11.500000-0.038564-0.019628		11.600000-0.036090-0.023189			
11.700000-0.033298-0.026456		11.800000-0.030223-0.029405			
11.900000-0.026899-0.032010		12.000000-0.023362-0.034253			
12.100000-0.019651-0.036118		12.200000-0.015806-0.037592			
12.300000-0.011867-0.038667		12.400000-0.007873-0.039339			
12.500000-0.003865-0.039609		12.600000	0.000118-0.039480		
12.700000	0.004036-0.038960	12.800000	0.007853-0.038060		
12.900000	0.011531-0.036794	13.000000	0.015038-0.035182		
13.100000	0.018342-0.033244	13.200000	0.021412-0.031005		
13.300000	0.024223-0.028490	13.400000	0.026750-0.025730		
13.500000	0.028973-0.022754	13.600000	0.030875-0.019596		
13.700000	0.032441-0.016288	13.800000	0.033661-0.012867		
13.900000	0.034529-0.009367	14.000000	0.035040-0.005824		
14.100000	0.035194-0.002274	14.200000	0.034996	0.001249	
14.300000	0.034453	0.004710	14.400000	0.033573	0.008076
14.500000	0.032372	0.011315	14.600000	0.030865	0.014396
14.700000	0.029070	0.017292	14.800000	0.027011	0.019976
14.900000	0.024710	0.022426	15.000000	0.022194	0.024619
15.100000	0.019491	0.026538	15.200000	0.016629	0.028167
15.300000	0.013639	0.029494	15.400000	0.010552	0.030510
15.500000	0.007400	0.031209	15.600000	0.004215	0.031588
15.700000	0.001029	0.031648	15.800000-0.002127	0.031392	
15.900000-0.005222	0.030827	16.000000-0.008226	0.029961		
16.100000-0.011111	0.028808	16.200000-0.013850	0.027382		
16.300000-0.016416	0.025702	16.400000-0.018788	0.023785		
16.500000-0.020944	0.021656	16.600000-0.022865	0.019336		
16.700000-0.024536	0.016851	16.800000-0.025942	0.014229		
16.900000-0.027073	0.011495	17.000000-0.027921	0.008680		
17.100000-0.028481	0.005811	17.200000-0.028750	0.002918		
17.300000-0.028731	0.000029	17.400000-0.028425-0.002827			
17.500000-0.027840-0.005621		17.600000-0.026984-0.008328			
17.700000-0.025869-0.010922		17.800000-0.024509-0.013377			
17.900000-0.022920-0.015672		18.000000-0.021121-0.017785			
18.100000-0.019131-0.019697		18.200000-0.016973-0.021392			
18.300000-0.014669-0.022856		18.400000-0.012244-0.024076			
18.500000-0.009723-0.025043		18.600000-0.007133-0.025750			
18.700000-0.004500-0.026193		18.800000-0.001850-0.026370			
18.900000	0.000791-0.026283	19.000000	0.003396-0.025935		
19.100000	0.005939-0.025332	19.200000	0.008397-0.024483		
19.300000	0.010746-0.023399	19.400000	0.012963-0.022094		
19.500000	0.015029-0.020581	19.600000	0.016923-0.018879		
19.700000	0.018630-0.017007	19.800000	0.020134-0.014984		
19.900000	0.021422-0.012832	20.000000	0.022484-0.010574		

KA= 1.300000

JMAX= 26

MSTAR= 28

KD RESIJ REACIJ

KD RESIJ REACIJ

2.700000 0.128277 0.168186
2.900000 0.081384 0.177887
3.100000 0.038286 0.177938
3.300000-0.000312 0.170230
3.500000-0.033846 0.156303
3.700000-0.061906 0.137540
3.900000-0.084240 0.115228
4.100000-0.100760 0.090576
4.300000-0.111533 0.064719
4.500000-0.116780 0.038705
4.700000-0.116857 0.013485
4.900000-0.112243-0.010103
5.100000-0.103524-0.031344
5.300000-0.091364-0.049658
5.500000-0.076488-0.064609
5.700000-0.059657-0.075901
5.900000-0.041638-0.083388
6.100000-0.023189-0.087061
6.300000-0.005029-0.087045
6.500000 0.012181-0.083584
6.700000 0.027855-0.077027
6.900000 0.041495-0.067815
7.100000 0.052710-0.056453
7.300000 0.061213-0.043497
7.500000 0.066836-0.029529
7.700000 0.069522-0.015134
7.900000 0.069325-0.000884
8.100000 0.066402 0.012684
8.300000 0.061001 0.025087
8.500000 0.053452 0.035908
8.700000 0.044146 0.044806
8.900000 0.033522 0.051532
9.100000 0.022050 0.055924
9.300000 0.010207 0.057920
9.500000-0.001533 0.057545
9.700000-0.012723 0.054916
9.900000-0.022953 0.050229

2.600000 0.152891 0.158891
2.800000 0.104406 0.174386
3.000000 0.059314 0.178989
3.200000 0.018386 0.174953
3.400000-0.017741 0.163954
3.600000-0.048580 0.147444
3.800000-0.073798 0.126750
4.000000-0.093226 0.103122
4.200000-0.106853 0.077730
4.400000-0.114828 0.051670
4.600000-0.117437 0.025941
4.800000-0.115102 0.001440
5.000000-0.108357-0.021056
5.200000-0.097830-0.040898
5.400000-0.084218-0.057576
5.600000-0.068269-0.070725
5.800000-0.050748-0.080124
6.000000-0.032422-0.085697
6.200000-0.014030-0.087502
6.400000 0.003734-0.085725
6.600000 0.020243-0.080667
6.800000 0.034956-0.072723
7.000000 0.047426-0.062369
7.200000 0.057314-0.050139
7.400000 0.064391-0.036603
7.600000 0.068545-0.022348
7.800000 0.069777-0.007957
8.000000 0.068191 0.006017
8.200000 0.063992 0.019059
8.400000 0.057472 0.030719
8.600000 0.048992 0.040615
8.800000 0.038970 0.048453
9.000000 0.027862 0.054026
9.200000 0.016145 0.057222
9.400000 0.004296 0.058023
9.600000-0.007223 0.056502
9.800000-0.017982 0.052815
10.000000-0.027595 0.047193

10.100000-0.031869	0.043747	10.200000-0.035740	0.039933		
10.300000-0.039178	0.035795	10.400000-0.042158	0.031379		
10.500000-0.044659	0.026736	10.600000-0.046668	0.021914		
10.700000-0.048173	0.016965	10.800000-0.049169	0.011938		
10.900000-0.049655	0.006886	11.000000-0.049638	0.001857		
11.100000-0.049125	0.003098	11.200000-0.048132	0.007933		
11.300000-0.046676	0.012603	11.400000-0.044780	0.017065		
11.500000-0.042470	0.021278	11.600000-0.039778	0.025205		
11.700000-0.036734	0.028814	11.800000-0.033377	0.032073		
11.900000-0.029743	0.034958	12.000000-0.025874	0.037445		
12.100000-0.021811	0.039517	12.200000-0.017598	0.041161		
12.300000-0.013278	0.042368	12.400000-0.008896	0.043133		
12.500000-0.004496	0.043455	12.600000-0.000122	0.043338		
12.700000	0.004185-0.042792	12.800000	0.008382-0.041827		
12.900000	0.012430-0.040461	13.000000	0.016291-0.038712		
13.100000	0.019931-0.036604	13.200000	0.023316-0.034163		
13.300000	0.026418-0.031419	13.400000	0.029210-0.028403		
13.500000	0.031669-0.025148	13.600000	0.033775-0.021691		
13.700000	0.035515-0.018069	13.800000	0.036875-0.014319		
13.900000	0.037847-0.010481	14.000000	0.038429-0.006593		
14.100000	0.038619-0.002695	14.200000	0.038422	0.001174	
14.300000	0.037844	0.004978	14.400000	0.036897	0.008678
14.500000	0.035596	0.012241	14.600000	0.033958	0.015633
14.700000	0.032003	0.018823	14.800000	0.029757	0.021782
14.900000	0.027244	0.024483	15.000000	0.024493	0.026905
15.100000	0.021535	0.029026	15.200000	0.018401	0.030830
15.300000	0.015125	0.032303	15.400000	0.011741	0.033435
15.500000	0.008284	0.034219	15.600000	0.004788	0.034651
15.700000	0.001290	0.034733	15.800000	0.002176	0.034468
15.900000	0.005577	0.033863	16.000000	0.008880	0.032928
16.100000	0.012053	0.031676	16.200000	0.015067	0.030124
16.300000	0.017893	0.028291	16.400000	0.020507	0.026199
16.500000	0.022884	0.023871	16.600000	0.025005	0.021333
16.700000	0.026851	0.018614	16.800000	0.028407	0.015741
16.900000	0.029662	0.012745	17.000000	0.030606	0.009658
17.100000	0.031234	0.006511	17.200000	0.031544	0.003336
17.300000	0.031536	0.000164	17.400000	0.031213	0.002973
17.500000	0.030583	0.006044	17.600000	0.029656	0.009020
17.700000	0.028444	0.011872	17.800000	0.026962	0.014574
17.900000	0.025228	0.017100	18.000000	0.023261	0.019428
18.100000	0.021085	0.021536	18.200000	0.018723	0.023406
18.300000	0.016200	0.025023	18.400000	0.013543	0.026373
18.500000	0.010780	0.027445	18.600000	0.007940	0.028233
18.700000	0.005050	0.028730	18.800000	0.002142	0.028936
18.900000	0.000758	0.028852	19.000000	0.003619	0.028480
19.100000	0.006414	0.027829	19.200000	0.009115	0.026908
19.300000	0.011698	0.025728	19.400000	0.014138	0.024303
19.500000	0.016412	0.022651	19.600000	0.018499	0.020791
19.700000	0.020380	0.018742	19.800000	0.022039	0.016527
19.900000	0.023462	0.014170	20.000000	0.024637	0.011695

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KA= 1.400000 JMAX= 26

MSTAR= 28

KD RESIJ REACIJ

KD RESIJ REACIJ

2.900000	0.095867	0.188129	2.800000	0.121264	0.182681
3.100000	0.048270	0.190504	3.000000	0.071503	0.190607
3.300000	0.005565	0.183719	3.200000	0.026264	0.188123
3.500000	-0.031629	0.169738	3.400000	-0.013754	0.177521
3.700000	-0.062858	0.150196	3.600000	-0.048011	0.160567
3.900000	-0.087842	0.126567	3.800000	-0.076141	0.138805
4.100000	-0.106477	0.100214	4.000000	-0.097953	0.113650
4.300000	-0.118831	0.072403	4.200000	-0.113428	0.086416
4.500000	-0.125136	0.044299	4.400000	-0.122719	0.058319
4.700000	-0.125776	0.016955	4.600000	-0.126135	0.030471
4.900000	-0.121268	-0.008702	4.800000	-0.124128	0.003863
5.100000	-0.112242	-0.031879	5.000000	-0.117276	-0.020644
5.300000	-0.099421	-0.051934	5.200000	-0.106258	-0.042331
5.500000	-0.083589	-0.068378	5.400000	-0.091830	-0.060632
5.700000	-0.065573	-0.080882	5.600000	-0.074802	-0.075137
5.900000	-0.046209	-0.089273	5.800000	-0.056008	-0.085596
6.100000	-0.026319	-0.093533	6.000000	-0.036230	-0.091915
6.300000	-0.006688	-0.093789	6.200000	-0.016425	-0.094149
6.500000	0.011962	-0.090298	6.400000	0.002802	-0.092491
6.700000	0.028990	-0.083433	6.600000	0.020715	-0.087260
6.900000	0.043851	-0.073665	6.800000	0.036721	-0.073879
7.100000	0.056114	-0.061539	7.000000	0.050330	-0.067860
7.300000	0.065463	-0.047654	7.200000	0.061167	-0.054777
7.500000	0.071707	-0.032638	7.400000	0.068980	-0.040247
7.700000	0.074779	-0.017126	7.600000	0.073639	-0.024904
7.900000	0.074732	-0.001738	7.800000	0.075138	-0.009379
8.100000	0.071729	0.012943	8.000000	0.073585	0.005725
8.300000	0.066035	0.026392	8.200000	0.069198	0.019852
8.500000	0.058001	0.038152	8.400000	0.062286	0.032508
8.700000	0.048050	0.047854	8.600000	0.053237	0.049280
8.900000	0.036653	0.055220	8.800000	0.042501	0.051842
9.100000	0.024315	0.060075	9.000000	0.030569	0.057968
9.300000	0.011555	0.062343	9.200000	0.017956	0.061333
9.500000	-0.001117	0.062049	9.400000	0.005177	0.062511
9.700000	-0.013216	0.059316	9.600000	-0.007267	0.060977
9.900000	-0.024297	0.054351	9.800000	-0.018909	0.057097
			10.000000	-0.029332	0.051118

USL Tech. Memo.
No. 960-17-65

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10.100000-0.033973	0.047437	10.200000-0.038182	0.043356
10.300000-0.041927	0.038921	10.400000-0.045180	0.034183
10.500000-0.047918	0.029195	10.600000-0.050125	0.024010
10.700000-0.051790	0.018683	10.800000-0.052905	0.013269
10.900000-0.053472	0.007823	11.000000-0.053493	0.002398
11.100000-0.052980	0.002951	11.200000-0.051946	0.008175
11.300000-0.050412	0.013224	11.400000-0.048402	0.018051
11.500000-0.045943	0.022613	11.600000-0.043069	0.026870
11.700000-0.039813	0.030785	11.800000-0.036216	0.034326
11.900000-0.032319	0.037463	12.000000-0.028164	0.040175
12.100000-0.023797	0.042439	12.200000-0.019264	0.044243
12.300000-0.014614	0.045575	12.400000-0.009894	0.046431
12.500000-0.005150	0.046810	12.600000-0.000431	0.046715
12.700000	0.004217-0.046135	12.800000	0.008750-0.045144
12.900000	0.013125-0.043698	13.000000	0.017301-0.041838
13.100000	0.021240-0.039589	13.200000	0.024907-0.036979
13.300000	0.028270-0.034040	13.400000	0.031300-0.030806
13.500000	0.033973-0.027312	13.600000	0.036268-0.023598
13.700000	0.038167-0.019702	13.800000	0.039657-0.015667
13.900000	0.040730-0.011534	14.000000	0.041382-0.007346
14.100000	0.041611-0.003144	14.200000	0.041422-0.001030
14.300000	0.040822-0.005135	14.400000	0.039824-0.009131
14.500000	0.038442-0.012981	14.600000	0.036696-0.016649
14.700000	0.034608-0.020100	14.800000	0.032202-0.023303
14.900000	0.029509-0.026231	15.000000	0.026557-0.028858
15.100000	0.023379-0.031163	15.200000	0.020010-0.033126
15.300000	0.016486-0.034733	15.400000	0.012844-0.035972
15.500000	0.009121-0.036837	15.600000	0.005354-0.037323
15.700000	0.001583-0.037431	15.800000	0.002156-0.037165
15.900000	0.005827-0.036530	16.000000	0.009393-0.035540
16.100000	0.012821-0.034208	16.200000	0.016079-0.032551
16.300000	0.019136-0.030590	16.400000	0.021965-0.028348
16.500000	0.024541-0.025850	16.600000	0.026840-0.023125
16.700000	0.028845-0.020202	16.800000	0.030538-0.017113
16.900000	0.031906-0.013890	17.000000	0.032940-0.010566
17.100000	0.033633-0.007177	17.200000	0.033983-0.003755
17.300000	0.033990-0.000335	17.400000	0.033658-0.003048
17.500000	0.032995-0.006363	17.600000	0.032010-0.009576
17.700000	0.030717-0.012657	17.800000	0.029132-0.019577
17.900000	0.027275-0.018309	18.000000	0.025166-0.020828
18.100000	0.022830-0.023112	18.200000	0.020292-0.025140
18.300000	0.017580-0.026895	18.400000	0.014722-0.028362
18.500000	0.011748-0.029532	18.600000	0.008689-0.030394
18.700000	0.005577-0.030943	18.800000	0.002442-0.031179
18.900000	0.000684-0.031101	19.000000	0.003770-0.030714
19.100000	0.006787-0.030025	19.200000	0.009704-0.029044
19.300000	0.012494-0.027783	19.400000	0.015130-0.026258
19.500000	0.017589-0.024488	19.600000	0.019847-0.022491
19.700000	0.021884-0.020291	19.800000	0.023682-0.017910
19.900000	0.025227-0.015375	20.000000	0.026504-0.012712

KA= 1.500000 JMAX= 28 MSTAR= 30
 KD RESIJ REACIJ KD RESIJ REACIJ

3.100000	0.059835	0.199300	3.000000	0.085148	0.197796
3.300000	0.013232	0.194352	3.200000	0.035834	0.198025
3.500000	-0.027466	0.180988	3.400000	-0.007890	0.188585
3.700000	-0.061764	0.161230	3.600000	-0.045438	0.171797
3.900000	-0.089354	0.136782	3.800000	-0.076409	0.149493
4.100000	-0.110117	0.109178	4.000000	-0.100589	0.123284
4.300000	-0.124118	0.079821	4.200000	-0.117952	0.094635
4.500000	-0.131598	0.049992	4.400000	-0.128651	0.064890
4.700000	-0.132962	0.020845	4.600000	-0.133013	0.035267
4.900000	-0.128756	-0.006605	4.800000	-0.131516	0.006850
5.100000	-0.119654	-0.031492	5.000000	-0.124771	-0.019417
5.300000	-0.106422	-0.053113	5.200000	-0.113503	-0.042749
5.500000	-0.089899	-0.070928	5.400000	-0.098517	-0.062523
5.700000	-0.070969	-0.084572	5.600000	-0.080679	-0.078288
5.900000	-0.050525	-0.093847	5.800000	-0.060880	-0.089761
6.100000	-0.029450	-0.098723	6.000000	-0.040013	-0.096831
6.300000	-0.008586	-0.099322	6.200000	-0.018941	-0.099543
6.500000	0.011292	-0.095910	6.400000	0.001522	-0.098096
6.700000	0.029492	-0.088879	6.600000	0.020641	-0.092818
6.900000	0.045428	-0.078722	6.800000	0.037775	-0.084157
7.100000	0.058628	-0.066018	7.000000	0.052394	-0.072650
7.300000	0.068752	-0.051400	7.200000	0.064091	-0.058907
7.500000	0.075586	-0.035538	7.400000	0.072588	-0.043582
7.700000	0.079052	-0.019107	7.600000	0.077740	-0.027351
7.900000	0.079198	-0.002768	7.800000	0.079532	-0.010886
8.100000	0.076191	0.012856	8.000000	0.078074	0.005170
8.300000	0.070309	0.027202	8.200000	0.073588	0.020221
8.500000	0.061919	0.039779	8.400000	0.066401	0.033739
8.700000	0.051467	0.050190	8.600000	0.056921	0.045277
8.900000	0.039453	0.058136	8.800000	0.045623	0.054486
9.100000	0.026413	0.063421	9.000000	0.033027	0.061119
9.300000	0.012896	0.065963	9.200000	0.019679	0.065036
9.500000	-0.000554	0.065784	9.400000	0.006129	0.066208
9.700000	-0.013419	0.063006	9.600000	-0.007091	0.064708
9.900000	-0.025226	0.057848	9.800000	-0.019483	0.060708
			10.000000	-0.030600	0.054466

10.100000-0.035560	0.050606	10.200000-0.040065	0.046316		
10.300000-0.044079	0.041646	10.400000-0.047575	0.036650		
10.500000-0.050526	0.031384	10.600000-0.052915	0.025903		
10.700000-0.054729	0.020267	10.800000-0.055961	0.014534		
10.900000-0.056610	0.008761	11.000000-0.056680	0.003007		
11.100000-0.056182	0.002672	11.200000-0.055131	0.008222		
11.300000-0.053547	0.013590	11.400000-0.051455	0.018728		
11.500000-0.048886	0.023587	11.600000-0.045872	0.028126		
11.700000-0.042452	0.032306	11.800000-0.038665	0.036091		
11.900000-0.034557	0.039451	12.000000-0.030171	0.042360		
12.100000-0.025558	0.044796	12.200000-0.020765	0.046745		
12.300000-0.015843	0.048195	12.400000-0.010843	0.049139		
12.500000-0.005816	0.049577	12.600000-0.000810	0.049812		
12.700000	0.004124-0.048954	12.800000	0.008939-0.047915		
12.900000	0.013589-0.046414	13.000000	0.018032-0.044472		
13.100000	0.022226-0.042116	13.200000	0.026134-0.039375		
13.300000	0.029721-0.036283	13.400000	0.032958-0.032874		
13.500000	0.035818-0.029188	13.600000	0.038277-0.025265		
13.700000	0.040318-0.021148	13.800000	0.041926-0.016879		
13.900000	0.043093-0.012504	14.000000	0.043812-0.008067		
14.100000	0.044084-0.003612	14.200000	0.043911	0.000815	
14.300000	0.043303	0.005172	14.400000	0.042271	0.009417
14.500000	0.040831	0.013508	14.600000	0.039003	0.017408
14.700000	0.036811	0.021081	14.800000	0.034281	0.024494
14.900000	0.031444	0.027616	15.000000	0.028330	0.030420
15.100000	0.024975	0.032884	15.200000	0.021416	0.034986
15.300000	0.017689	0.036712	15.400000	0.013835	0.038049
15.500000	0.009892	0.038989	15.600000	0.005902	0.039528
15.700000	0.001903	0.039665	15.800000	0.002063	0.039404
15.900000	0.003959	0.038754	16.000000	0.009746	0.037725
16.100000	0.013389	0.036333	16.200000	0.016852	0.034595
16.300000	0.020105	0.032534	16.400000	0.023118	0.030173
16.500000	0.025863	0.027540	16.600000	0.028317	0.024664
16.700000	0.030459	0.021576	16.800000	0.032271	0.018310
16.900000	0.033740	0.014901	17.000000	0.034855	0.011383
17.100000	0.035609	0.007792	17.200000	0.035999	0.004166
17.300000	0.036025	0.000541	17.400000	0.035691	0.003048
17.500000	0.035006	0.006566	17.600000	0.033979	0.009978
17.700000	0.032624	0.013251	17.800000	0.030960	0.016356
17.900000	0.029005	0.019262	18.000000	0.026783	0.021944
18.100000	0.024318	0.024377	18.200000	0.021638	0.026541
18.300000	0.018772	0.028415	18.400000	0.015749	0.029986
18.500000	0.012602	0.031241	18.600000	0.009364	0.032170
18.700000	0.006067	0.032769	18.800000	0.002744	0.033035
18.900000	0.000570	0.032968	19.000000	0.003844	0.032573
19.100000	0.007045	0.031857	19.200000	0.010142	0.030831
19.300000	0.013106	0.029508	19.400000	0.015909	0.027905
19.500000	0.018524	0.026040	19.600000	0.020928	0.023934
19.700000	0.023098	0.021611	19.800000	0.025016	0.019096
19.900000	0.026665	0.016416	20.000000	0.028032	0.013599

KA= 1.580000 JMAX= 28

MSTAR= 30

KD RESIJ REACIJ

KD RESIJ REACIJ

3.300000 0.020734 0.200216
 3.500000-0.022617 0.187999
 3.700000-0.059268 0.168572
 3.900000-0.088889 0.143900
 4.100000-0.111348 0.115680
 4.300000-0.126706 0.085434
 4.500000-0.135208 0.054537
 4.700000-0.137270 0.024224
 4.900000-0.133461-0.004424
 5.100000-0.124476-0.030484
 5.300000-0.111116-0.053203
 5.500000-0.094255-0.072005
 5.700000-0.074812-0.086492
 5.900000-0.053723-0.096449
 6.100000-0.031911-0.101830
 6.300000-0.010257-0.102754
 6.500000 0.010425-0.099489
 6.700000 0.029410-0.092434
 6.900000 0.046078-0.082099
 7.100000 0.059935-0.069081
 7.300000 0.070615-0.054036
 7.500000 0.077890-0.037660
 7.700000 0.081671-0.020654
 7.900000 0.082002-0.003709
 8.100000 0.079050 0.012529
 8.300000 0.073098 0.027467
 8.500000 0.064525 0.040595
 8.700000 0.053789 0.051494
 8.900000 0.041408 0.059848
 9.100000 0.027936 0.065450
 9.300000 0.013944 0.068209
 9.500000-0.000002 0.068143
 9.700000-0.013363 0.065375
 9.900000-0.025647 0.060128

3.200000 0.044765 0.202859
 3.400000-0.001751 0.195148
 3.600000-0.041805 0.179055
 3.800000-0.074970 0.156781
 4.000000-0.101015 0.130135
 4.200000-0.119903 0.100721
 4.400000-0.131792 0.069986
 4.600000-0.137012 0.039236
 4.800000-0.136059 0.009630
 5.000000-0.129568-0.017829
 5.200000-0.118290-0.042301
 5.400000-0.103066-0.063122
 5.600000-0.084797-0.079805
 5.800000-0.064415-0.092044
 6.000000-0.042851-0.099708
 6.200000-0.021012-0.102835
 6.400000 0.000253-0.101623
 6.600000 0.020171-0.096406
 6.800000 0.038068-0.087641
 7.000000 0.053384-0.075886
 7.200000 0.065689-0.061769
 7.400000 0.074687-0.045971
 7.600000 0.080218-0.029192
 7.800000 0.082260-0.012132
 8.000000 0.080921 0.004537
 8.200000 0.076428 0.020194
 8.400000 0.069112 0.034286
 8.600000 0.059396 0.046346
 8.800000 0.047770 0.056004
 9.000000 0.034772 0.063001
 9.200000 0.020969 0.067187
 9.400000 0.006931 0.068524
 9.600000-0.006788 0.067085
 9.800000-0.019669 0.063044
 10.000000-0.031246 0.056667

10.100000-0.036420	0.052707	10.200000-0.041125	0.048297		
10.300000-0.045324	0.043489	10.400000-0.048987	0.038338		
10.500000-0.052088	0.032902	10.600000-0.054608	0.027240		
10.700000-0.056532	0.021412	10.800000-0.057853	0.015479		
10.900000-0.058570	0.009501	11.000000-0.058686	0.003537		
11.100000-0.058212	-0.002353	11.200000-0.057164	-0.008113		
11.300000-0.055562	-0.013689	11.400000-0.053431	-0.019028		
11.500000-0.050803	-0.024084	11.600000-0.047712	-0.028810		
11.700000-0.044197	-0.033166	11.800000-0.040299	-0.037115		
11.900000-0.036064	-0.040625	12.000000-0.031539	-0.043670		
12.100000-0.026774	-0.046227	12.200000-0.021821	-0.048279		
12.300000-0.016730	-0.049814	12.400000-0.011554	-0.050826		
12.500000-0.006347	-0.051313	12.600000-0.001159	-0.051279		
12.700000	0.003957-0.050732	12.800000	0.008954-0.049687		
12.900000	0.013783-0.048161	13.000000	0.018399-0.046177		
13.100000	0.022760-0.043761	13.200000	0.026826-0.040945		
13.300000	0.030563-0.037763	13.400000	0.033938-0.034251		
13.500000	0.036924-0.030448	13.600000	0.039496-0.026398		
13.700000	0.041635-0.022144	13.800000	0.043327-0.017730		
13.900000	0.044562-0.013203	14.000000	0.045333-0.008609		
14.100000	0.045640-0.003995	14.200000	0.045487	0.000594	
14.300000	0.044882	0.005112	14.400000	0.043836	0.009515
14.500000	0.042367	0.013763	14.600000	0.040495	0.017814
14.700000	0.038245	0.021632	14.800000	0.035642	0.025182
14.900000	0.032719	0.028433	15.000000	0.029508	0.031356
15.100000	0.026046	0.033926	15.200000	0.022368	0.036124
15.300000	0.018516	0.037932	15.400000	0.014530	0.039338
15.500000	0.010450	0.040332	15.600000	0.006318	0.040911
15.700000	0.002176	0.041074	15.800000	-0.001935	0.040825
15.900000	-0.005975	0.040171	16.000000	-0.009904	0.039125
16.100000	-0.013685	0.037700	16.200000	-0.017283	0.035917
16.300000	-0.020663	0.033798	16.400000	-0.023796	0.031366
16.500000	-0.026654	0.028652	16.600000	-0.029210	0.025684
16.700000	-0.031444	0.022496	16.800000	-0.033338	0.019121
16.900000	-0.034876	0.015595	17.000000	-0.036048	0.011956
17.100000	-0.036846	0.008239	17.200000	-0.037267	0.004484
17.300000	-0.037311	0.000728	17.400000	-0.036983	-0.002992
17.500000	-0.036289	-0.006639	17.600000	-0.0352	-0.010179
17.700000	-0.033852	-0.013577	17.800000	-0.032142	-0.016801
17.900000	-0.030130	-0.019821	18.000000	-0.027840	-0.022609
18.100000	-0.025297	-0.025141	18.200000	-0.022530	-0.027394
18.300000	-0.019569	-0.029349	18.400000	-0.016444	-0.030990
18.500000	-0.013190	-0.032304	18.600000	-0.009839	-0.033281
18.700000	-0.006425	-0.033916	18.800000	-0.002984	-0.034205
18.900000	0.000450	-0.034150	19.000000	0.003843	-0.033755
19.100000	0.007163	-0.033027	19.200000	0.010376	-0.031977
19.300000	0.013452	-0.030619	19.400000	0.016362	-0.028970
19.500000	0.019079	-0.027048	19.600000	0.021578	-0.024876
19.700000	0.023836	-0.022479	19.800000	0.025833	-0.019881
19.900000	0.027553	-0.017111	20.000000	0.028980	-0.014198

DISTRIBUTION LIST

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USL Code	100	(Copy #1)
	101	(" #2)
	900	(" #3)
	900C	(" #4)
	960 (2)	(" #5-#6)
	960S	(" #7)
	961	(" #8)
	902	(" #9)
	904.2 (5)	(" #10-#14)
D. T. Porter	(2)	(" #15-#16)
N. T. Chin		(" #17)
H. L. Rathbun		(" #18)
W. J. Marshall		(" #19)

External

Ernst Prasse (Raytheon)	(" #20)
David Lower (GE/HMED)	(" #21)
V. [unclear] (HRL)	(" #22)
J. [unclear] (HRL)	(" #23)
L. [unclear] (HRL)	(" #24)
S. [unclear] (HRL)	(" #25)
G. [unclear] (HRL)	(" #26)
C. [unclear] (HRL)	(" #27)

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